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MOLLUSCS OF PORIRUA HARBOUR

Wellington Shell Club Bulletin No. 14 1968, consisted of a list of mollusca collected in the Pauatahanui Inlet (the northern arm of Porirua Harbour). That list has now been updated both in respect of some species subsequently collected, and the nomenclatural changes necessary. It also includes some species which have been located in the southern arm of the harbour but not in the northern arm. The revised list is therefore being issued as a list of the molluscan fauna of the whole of Porirua Harbour.

No doubt further species will be found in the area, and the Club will be pleased to receive information regarding any additions which can be made to the list.

The species names and the order of listing are as in the 5th edition of Powell's "Shells of New Zealand" 1976.

AMPHINEURA

Terenochiton inquinatus(Reeve 1847)
Ischnochiton maorianus Iredale 1914
Amaurochiton glaucus (Gray 1828)
Sypharochiton pelliserpentis (Quoy & Gaimard 1835)
Acanthochitona zelandica (Quoy & Gaimard 1835)

GASTROPODA

Haliotis iris Gmelin 1791
Haliotis australis Gmelin 1791
Scutus breviculus (Blainville 1817)
Cellana ornata (Dillwyn 1817)
Cellana radians (Gmelin 1791)
Asteracmea suteri (Iredale 1915)
Notoacmea daedala (Suter 1907)
Notoacmea helmsi (Smith 1894)
Atalacmea fragilis (Sowerby 1823)
Melagraphia aethiops (Gmelin 1791)
Diloma zelandica (Quoy & Gaimard 1834)
Diloma subrostrata (Gray 1835)
Diloma bicanaliculata (Dunker 1844)
Micrelenchus sanguineus (Gray 1843)
Micrelenchus tenebrosus (Adams 1853)
Cantharidella tesselata (Adams 1851)
Trochus tiaratus Quoy & Gaimard 1834
Maurea pellucida (Valenciennes 1846)
Maurea punctulata (Martyn 1784)
Umbonium zelandicum (Hombron & Jacquinot 1854)
Antisolarium egenum (Gould 1849)
Turbo smaragdus Gmelin 1791
Cookia sulcata(Gmelin 1791)
Elachorbis subtatei (Suter 1907)
Littorina cincta (Quoy & Gaimard 1833)
Littorina unifasciata antipodum Philippi 1847
Risselopsis varia (Hutton 1873)
Eatoniella limbata (Hutton 1883)
Estea rekohuana Powell 1933
Rissoina chathamensis (Hutton 1873)
Potamopyrgus antipodarum (Gray 1843)
Maoricolpus roseus (Quoy & Gaimard 1834)
Zeacolpus vittatus (Hutton 1873)

Zeacumantus lutulentus (Kiener 1841)
Zeacumantus subcarinatus (Sowerby 1855)
Struthiolaria papulosa (Martyn 1784)
Trichosirius inornatus (Hutton 1873)
Sigapatella novaezelandiae Lesson 1831
Zegalerus tenuis (Gray 1867)
Maoricrypta monoxyla (Lesson 1831)
Tanea zelandica (Quoy & Gaimard 1832)
Xymene plebeius (Hutton 1873)
Xymene ambiguus (Philippi 1844)
Xymene traversi (Hutton 1873)
Haustrum haustorium (Gmelin 1791)
Thais orbita (Gmelin 1791)
Lepsiella scobina (Quoy & Gaimard 1833)
Paxula paxillus (Murdoch 1905)
Zemitrella chaova (Reeve 1859)
Cominella adspersa (Brugiere 1789)
Cominella maculosa (Martyn 1784)
Cominella glandiformis (Reeve 1847)
Buccinulum lineum (Martyn 1784)
Buccinulum vittatum littorinoides (Reeve 1846)
Penion sulcatus (Lamarck 1816)
Amalda australis (Sowerby 1830)
Alcithoe arabica (Gmelin 1791)
Austromitra rubiginosa (Hutton 1873)
Neoguraleus finlayi Powell 1942
Neoguraleus interruptus Powell 1942
Neoguraleus sinclairi (Gillies 1882)
Turbonilla sp.
Odostomia incidata Suter 1908
Haminoea zelandiae (Gray 1843)
Cylichnina striata (Hutton 1873)
Archidoris wellingtonensis (Abraham 1877)
Ctenodoris flabellifera (Cheeseman 1881)
Onchidella patelloides (Quoy & Gaimard 1832)
Siphonaria zelandica Quoy & Gaimard 1833
Amphibola crenata (Gmelin 1791)
Ophicardelus costellaris (Adams 1854)
Marinula filholi Hutton 1878

BIVALVIA

Nucula hartvigiana Pfeiffer 1864
Nucula nitidula Adams 1856
Solemya parkinsoni Smith 1874
Barbatia novaezelandiae (Smith 1915)
Glycymeris modesta (Angas 1879)
Mytilus edulis aoteanus Powell 1958
Perna canaliclus (Gmelin 1791)
Aulacomya ater maorianus (Iredale 1915)
Xenostrobus pulex (Lamarck 1819)
Modiolarca impacta (Hermann 1782)
Atrina zelandica (Gray 1835)
Ostrea lutaria Hutton 1873
Pecten novaezelandiae Reeve 1853
Chlamys zelandiae (Gray 1843)
Monia zelandica (Gray 1843)
Divaricella huttoniana (Vanatta 1901)
Lasaea rubra hinemoa Finlay 1928
Arthritica bifurca (Webster 1908)
Arthritica crassiformis Powell 1933
Pleuromeris zelandica (Deshayes 1854)

Benthocardiella sp.
Mactra discors Gray 1837
Mactra ovata (Gray 1843)
Spisula aequilateralis (Deshayes 1854)
Zenatia acinaces (Quoy & Gaimard 1835)
Resania lanceolata Gray 1852
Paphies australis (Gmelin 1791)
Paphies subtriangulata (Wood 1828)
Tellina gaimardi (Iredale 1915)
Tellina liliana Iredale 1915
Gari stangeri (Gray 1843)
Soletellina siliqua Reeve 1857
Leptomya retiaria (Hutton 1885)
Dosinia subrosea (Gray 1835)
Tawera spissa (Deshayes 1835)
Protothaca crassicosta (Deshayes 1835)
Notirus reflexus (Gray 1843)
Venerupis largillierti (Philippi 1849)
Chione stutchburyi (Wood 1828)
Bassina yatei (Gray 1835)
Corbula zelandica Quoy & Gaimard 1835
Hiatella arctica (Linnaeus 1767)
Panopea zelandica (Quoy & Gaimard 1835)
Anchomasa similis (Gray 1835)
Myadora striata (Quoy & Gaimard 1835)

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NOTES ON SOME AUSTRALIAN SHELLS IN NEW ZEALAND

--continued.

BY W.J. PAUL

5. MONTFORTULA RUGOSA (Quoy & Gaimard 1834)

In 1928 Margaret Mestayer applied the name Montfortula lyallensis to a new species of shell on the basis of a single specimen found in washed up material at Lyall Bay, Wellington. For a long time the type was the only specimen known of this species. A second specimen was , however, found in beach material at Eastbourne some years later.
Also in 1928 Finlay named Montfortula chathamensis based on shells collected at the Chatham Islands.
The next recording of a Montfortula in New Zealand was at Kaikoura. The locating of shells there conforming to the Australian Montfortula rugosa Quoy & Gaimard formed the basis of Dr. R. K. Dell's paper "The Rediscvery of Montfortula (Mollusca: Fissurellidae) in New Zealand " in 1971. Examination of the New Zealand material in comparison with Australian shells showed that the three apparent groups in New Zealand are in fact populations of the species rugosa.
In Australia the species has a very wide distribution, extending from the mouth of the Swan River in Western Australia to approximately halfway up the Queensland coast, and including Tasmania. Shells from the eastern half of this area had been treated as a separate species, Montfortula conoidea (Reeve 1842), but inconsistencies in the few distinguishing features has caused conoidea to now be treated as a synonym of rugosa.
The type locality of Montfortula rugosa is King George Sound in South Western Australia, the type having been collected there when the "Astrolabe" was in the Sound.
Emarginula stellata Adams 1851 is also a synonym of rugosa, the type being a juvenile of rugosa.

6. GADINIA CONICA (Angas 1867)

In 1910 Iredale commented that one species of this genus was to be found in Australia, New Zealand and the Kermadecs. Today this concept is accepted, but in the meantime some confusion has been added to the nomenclature picture. Finlay contended in 1927 that the New Zealand shells should be treated as a separate species and the name Gadinia nivea Hutton 1878 should be maintained for it. In 1940 Iredale erected the genus Gadinalea based on the Australian species Gadinalea conica and this has been used to include our New Zealand shell.
At one stage in its history the genus Trimusculus Schmidt 1833 was used for the New Zealand species.

Comparison of New Zealand and Australian material has shown that there are no adequate grounds for separation of the two groups, and that being the case, the earlier name Gadinia conica should be used for the populations on both sides of the Tasman.

In Australia the species ranges from the south west corner of Western Australia to southern Queensland, including Tasmania, although it is uncommon in the island state.
Siphonaria albida described by Angas in 1878 from South Australia and now included in Gadinia, is very closely related, and may in fact be a form of the same species.

7. SILIQUARIA WELDII (Tenison=Woods 1876)

This species, originally named by Tenison-Woods in the genus Tenagodes, has been long recorded in Pyxipoma. Readers will now have noted that in the 5th edition of Powell's 'Shells of New Zealand' it is listed in Siliquaria; the use of the genus Pyxipoma having been dropped.

The living habit of this mollusc is rather unusual as it lives mainly in sponges. Occasional specimens are collected washed up on beaches, but living specimens are obtained by dredging. Colonies are obtained embedded in sponge. In Wellington Shell Club Bulletin No. 28 (October 1971), Mrs Wolf described how she collected at Arkles Bay, Whangaparoa Peninsula, a large lump of sponge, which, when pulled to pieces, was found to contain 208 specimens ranging from juveniles of 2mm to adults of 23mm in length. For a species having this type of habitat, Siliquaria weldii has a surprisingly wide geographical distribution. In New Zealand it occurs in the Aupourian and Cookian mainland provinces and at the Chatham Islands. On the other side of the Tasman Sea it is found from New South Wales through Victoria and South Australia to Western Australia. Hedley recorded it from as far north as Geraldton. It is also in Tasmania.

8. CLEIDOTHAERUS ALBIDUS (Lamarck 1819)

It has now been established that the shell we have known in New Zealand as Cleidothaerus maorianus Finlay 1927 is the same species as the Australian Cleidothaerus albidus . In Suter's 'Manual of the New Zealand Mollusca' 1913 this shell was recorded as Chamostrea albida. Iredale in 1915 brought the genus Cleidothaerus into use, and in 1927 Finlay renamed the New Zealand shell Cleidothaetus maorianus . Rea ers will have observed that in the 5th edition of his 'Shells of New Zealand' Powell has reverted to the use of the specific name albidus, on the grounds of the identity of the New Zealand and Australian shells.

In their ' Marine Molluscs of Victoria' 1962, Macpherson and Gabriel commented thet Cleidothaerus albidus occurs in New Zealand but they did not discuss the question of maorianus being a synonym of albidus.

The species is widely distributed in New Zealand, being found in the Aupourian and Cookian provinces and at the Chatham Islands. The Australian range of the species is from New South Wales to Western Australia, and including Tasmania.

CLASSIFICATION OF THE GASTROPODA

By Dr A.G.Beu

Within the Class Gastropoda several different features can be used to construct a classification, such as the shell features, the radula, the gills, the gut,nerve and reproduction anatomy, the kidneys and so on. Opinions have differed a lot over the years on which features should be given most importance in such a classification. Consequently a lot of different classifications have resulted. From Troschel's great work 'Das Gebiss der Schnecken' toward the end of last century, and from subseqent major classifications of all the gastropods by Thiele and Wenz, it has generally been accepted in recent decades that gastropods can be divided into the following groups:-

Sub-class	Prosobranchia
Order	Archaeogastropoda
Order	Mesogastropoda
Order	Neogastropoda
Sub-class	Opisthobranchia Containing II Orders (discussed in text below)
Sub-class	Pulmonata Containing 2 Orders (discussed in text below where consideration is given to the combination of the latter 2 Sub-classes as is now done by many authors)

I assume readers will be most interested in the Prosobranchia, the main group of shelled marine gastropods, as the bulk of the shells in collections come into this Sub-class.

However, when brought down to basics, there is very little separating any of these groups. For instance, an average Opisthobranch differs from an average Prosobranch in:-

1. having a radula with numerous diverse teeth in one row, rather than numerous similar ones, or 7, or 5, or fewer as seen in Prosobranchs.
2. being a hermaphrodite, with no penis, whereas almost all Prosobranchs have males and females as separate individuals, and the male has a penis.
3. having wide, flattened tentacles with the eyes near the mid-line, rather than narrow, tapering tentacles with eyes on swellings near their outer bases.
4. lacking a prominent gland in the oesophagus, which is present in virtually all Prosobranchs.
5. having a hyperstrophically coiled protoconch, rather than an orthostrophic one.
6. lacking an osphadium, which is present in all Prosobranchs Prosobranchs.
7. having its eggs in gelatinous masses or long gelatinous strings, individual eggs being joined by 'threads'

called chalazae; whereas they are in discrete, protein-walled capsules in most Prosobranchs.

8. lacking a shell in most species, whereas most Prosobranchs have a shell.

9. lacking an operculum, whereas most Prosobranchs have an operculum.

10. various other anatomical differences in proboscis, nerves, gills, presence or absence of pigmented mantle organs etc..

The differences between Opisthobranchia and Pulmonata are much less marked, so most of the recent major classifications no longer keep these two Sub-classes separate, but unite them into one Sub-class, Euthyneura. The name to match this, to replace the word Prosobranchia, is Streptoneura. Almost all molluscan taxonomists now recognise only these two Sub-classes of the Gastropoda.

However to distinguish between these two can be difficult at times. There is one group of rather odd gastropods, for which Habe and Kosuge in 1966 proposed the Order Heterogastropoda, which shares almost equally the features of the Mesogastropoda and Euthyneura. This Order includes the Families Epitoniidae, Janthinidae, Mathildidae, Architectonicidae, Omalaxidae and perhaps the Triphoridae. Except for the Epitoniidae and the very closely related Janthinidae, all heterogastropods have heterostrophic protoconchs, or, in the case of Triphoridae, the whole protoconch and teleoconch are sinistral. In the Architectonicidae the protoconch is dextral and hyperstrophic, and looks the same as being sinistral and orthostrophic; so to fit it onto a dextral orthostrophic teleoconch, it must appear upside-down, and protrudes down into the umbilicus of the teleoconch.

All heterogastropods are hermaphrodites lacking a penis, having radulae consisting of rows of many similar needle-like teeth (except some architectonicids), have chalazae connecting their eggs (or, in Epitoniidae, connecting small capsules of eggs in a long string), have no oesophageal gland, and have the Euthyneuran kind of proboscis and nerve complex. However, they resemble mesogastropods in having large, solid, spiral shells that the animal can contract into completely, in having eyes on the outer edges of narrow tentacles, in having osphradia, and (except in Janthinidae) in having opercula in adults. So, are the Heterogastropoda to be regarded as Mesogastropoda or Euthyneura? Nobody can really say which is their better position at present. Maybe time will tell, as more information comes to light. Opinion suggests at present they are perhaps best regarded as small remnant groups from the kind of Mesogastropoda that were the ancestors of the Euthyneura. Some of their features are shared with undoubted primitive Euthyneura. For instance, some Cephalaspidea, such as Acteon, have an operculum; and their shells are not too different from those of the Pyramidellidae, now generally regarded as minute, specialised, suctorial Euthyneura. The contention is that Heterogastropoda, all being specialised suctorial feeders on coelenterates such as sea anemones and corals, have managed to hang on in their specialised habitats while their relatives were evolved along the lines of reducing the shell, widening

the tentacles, losing the osphradium, and so on. So perhaps they are best regarded as the most primitive Euthyneura.

All this has been included to show that gastropod classification is by no means clear cut as yet.

I will now discuss the major divisions and describe their main features.

Sub-class Streptoneura (= Prosobranchia)
Order Archaeogastropoda

These animals produce shells with a pearly (nacreous) inner layer, which is absent in other gastropods. The most primitive members (Pleurotomariacea) have remnants of a bilaterally symmetrical arrangement of the mantle cavity organs, so that Pleurotomaria itself retains left and right gills etc., unlike all other living gastropods. This means that the anus and the excurrent shell aperture have to come out a slit, groove, or row of holes behind the normal shell margin. Later families are similar but have only the left gill and so on, as in other gastropods, and consequently have a continuous peristome (in other words, a complete round aperture). All are herbivores, and so have many similar teeth in one radular row. The Neritacea are a highly specialised group that may have evolved independently of the other Archaeogastropoda.

The main Superfamilies of Archaeogastropoda are:

Pleurotomariacea
Fissurellacea
Patellacea
Trochacea
Neritacea

Order Mesogastropoda

These constitute the largest group of prosobranchs. They are a very diverse group occupying many ecological niches. They include algal grazers, deposit feeders, filter feeders right through to carnivores,. The highest evolved ones are carnivores and so resemble neogastropods through convergent evolution. Mesogastropods are probably the ancestors of many other evolutionary lines that led to all other living gastropod groups (although neogastropods may have evolved from archaeogastropods rather than from mesogastropods). Virtually all Mesogastropoda have seven teeth in one radular row, differentiated into a central, flanked on each side by a lateral and two marginal teeth. The shells lack a pearly layer. Nearly all have well developed shells. The primitive spiral ones have a continuous peristome, but more advanced ones (Tonnacea, Strombacea, Cypreacea, Cerithiacea) are siphonostomatous.

The development of a canal paralells, of course, the development of a siphon in the animal. The siphon is a tube to take water into the mantle cavity from ahead of the crawling animal, to detect food, enemies etc.. It is really a mechanism for directing water onto the chemoreception organ, the osphradium, equivalent to our noses ; so the development of a siphon indicates that higher mesogastropods have a more elaborate and efficient osphradium than

lower ones.
Mesogastropoda lack a few relatively small but significant anatomical organs (a second type of salivary gland, the rectal pouch, a gonopericardial duct in the male reproductive system) that are present in both Archaeogastropoda and Neogastropoda. The salivary ducts pass through the circumoesophageal nerve ring in mesogastropods, but around it in Archaeogastropoda and Neogastropoda. Finally, the oesophagus has been elongated into its various glandular regions by elongation of different parts - always behind the nerve ring in Mesogastropoda, and different areas in front of the nerve ring in various groups of Neogastropoda.

In a monumental paper in "Malacologia" in 1973, Dr W.F. Ponder concluded that the Mesogastropoda and Neogastropoda both evolved independently from Archaeogastropoda, probably early in Mesozoic time. Therefore he has retained the two Orders, Mesogastropoda and Neogastropoda, and has not united them into a single Order, Caenogastropoda, recognised by some recent workers, notably in the 'Treatise on Invertebrate Palaeontology'.

The main Superfamilies of Mesogastropoda are:

Cyclophoracea
Viviparacea
Littorinacea
Rissoacea
Cerithiacea
Strombacea
Hipponicacea
Calyptraeacea
Lamellariacea
Cypraeacea
Atlantacea
Naticacea
Tonnacea

Order Neogastropoda

This group is much better known than the others, thanks to Ponder's major review paper.

All are siphonostomatous carnivores; many having much longer siphonal canals than any mesogastropods. The radula of almost all groups is reduced to three teeth in a row, and several groups have only one tooth or no radula at all. The Family Cancellariidae have a most weird radula consisting of many long, thin, hair-like tubular teeth, perhaps all central teeth (but that is not certain). Hence they have been put in a separate Superfamily of their own. There are several anatomical differences from the Mesogastropoda, as I have already pointed out.

Earlier workers have divided this Order into two Sub-Orders and four or five Superfamilies; but Ponder has shown that it is an anatomically homogeneous group, and he recommended the recognition of no Sub-Orders and only three Superfamilies as follows:-

Muricacea --- containing almost all the 'standard' Neogastropoda i.e. Muricidae, Buccinidae, Fasciolariidae, Mitridae, Volutidae, Olividae etc.

Cancellariacea --- containing Cancellariidae, and the related extinct Family, Paladmetidae

Conacea---- containing Turridae, Terebridae and Conidae. Some of these have relatively primitive fore-gut anatomy and radulae, similar to those of Muricaea, but many genera have evolved a simplified fore-gut, a poison gland, and a radula reduced to a set of poison darts. These are the most highly evolved prosobranchs (=streptoneurans).

The family classification of the Muricacea, Ponder discussed at length, as he felt that there is no anatomical justification for regarding Muricidae, Buccinidae, Fasciolariidae, Nassariidae and all their related smaller families (Columbariidae, Colubrariidae, Columbellidae, Melongenidae etc.) as more than sub-families of the one Family, Muricidae. Certainly it appears that most of the sub-families recognised in these families at present are of little significance.

However, in his paper, Ponder has taken the conservative line and recognised in the Muricacea the Families Muricidae, Columbariidae, Columbellidae, Colubrariidae, Buccinidae, Magillidae, Nassariidae, Melongenidae, Fasciolariidae, Volutidae, Marginellidae, Volutomitridae, Vexillidae, Mitridae, Olividae, Harpidae, Vasidae (17 families).

Certainly we must learn to accept that there are no reasons for continuing to recognise the local New Zealand 'families' recognised by Finlay and Powell, such as Buccinulidae, Neptunidae, Cominellidae and Thaididae.

Powell has eliminated these in the 5th edition of his 'Shells of New Zealand'.

Sub-class Euthyneura (=Opisthobranchia plus Pulmonata)

I don't propose to deal with this group in as much detail as I have done with the Streptoneura, as they are mainly either shell-less (if marine) or the main groups of fresh-water and terrestial snails and slugs, which are not generally of interest to most shell collectors. It is a large group with about 3,100 genera (there are about 4,200 in the Streptoneura . I will list the 13 Orders, and briefly describe each:

Order Heterogastropoda

Epitoniacea, Architectonicacea, and perhaps Triphoracea, The Order was recently separated from the Mesogastropoda as explained earlier.

Order Entomotaeniata

Nerinacea (extinct ancestors of the opisthobranchs) and Pyramidellacea; probably also Eulimacea etc. from Mesogastropoda ----- mainly small, suctorial, tall and narrow shelled opisthobranchs.

Order Cephalaspidea

The 'bubble shells' shelled opisthobranchs --- Acteonacea, Philinacea, Bullacea etc.

Order Acochlidiacea

Family Acochlidiidae, and other minute slugs living in sand.

Order Philinoglossacea

Another small group of sand-dwellers.

Order Thecostomata

The shelled Pteropods.

Order Basommatophora

Siphonariidae, Amphibolidae, Ellobiidae and the main families of fresh-water snails --- in these families the eyes are at the bases of cephalic tentacles.

Order Stylommatophora

This is by far the largest Order of gastropods, with over 2,100 genera. It is divided into four sub-orders, and contains the main families of terrestial snails and slugs --- in these families the eyes are at the tips of cephalic tentacles.

Order Sacoglossa

Superfamilies Oxynoacea, Elysiacea and Jiliacea- small, specialised green sea-slugs with shells, living on seaweeds (mainly Caulerpa); includes the so-called 'bivalved gastropods'.

Order Anaspidea

The sea-hares, Family Aplysiidae, and their relatives.

Order Gymnosomata

The shell-less pteropods.

Order Notaspidea

Umbraculidae and Pleurobranchidae --- shelled, side-gilled marine slugs.

Order Nudibranchia

The true sea-slugs; naked, secondarily untorted marine slugs; divided into 5 sub-orders and 38 families.

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DIVING FOR SHELLS AT KAPITI ISLAND

By Debbie Walton

We stopped the boat halfway along the north end of Kapiti Island in 50' of water and prepared for a dive on a boulder-bank rich with marine life.

After splashing into the water we could see the bottom exceptionally well --- 100' visibility. We dived straight down to the sea bottom which was covered in various brown seaweeds.

Beneath the weed were rocks forming large crevasses, some of which had conger eels within.

In little pockets formed by the rocks and sand were Sigapatella novaezelandiae, many of them with their purplish mouths up. Jammed beneath two encrusted and algae covered rocks was an abandoned Maurea tigris with a soft green algae growing on its back.

Searching beneath the seaweed and within the crevasses for crayfish, I saw an Astrea heliotropium slowly making its way beneath weed stalks. I picked it up and checked its spines. Several were broken and it was heavily encrusted so I put it back.

Several yards away from me where my father was looking beneath the roof of a crevasse, he came across a large, perfect live specimen of Charonia capax. This was an important find added to later when I came across a good specimen of Mayena australasia. This one had a hermit crab in residence.

A red colour took my notice and I found it to be a cluster of seven Terebratella inconspicua attached firmly to an empty pair of Barbatia novaezelandiae . Nearby was an abandoned pair of Glycymeris laticostata. Several other pairs were found during the dive.

The small paua, Haliotis virginea was seen several times during the dive, usually with their irridescent mouths upward, glinting in the light. I have not as yet come across live specimens of this shell.

Within the weed were many live Cookia sulcata and Turbo smaragdus. The country was ideal for Turbogranosus. I had recently found some at the south end of Kapiti; both large and small specimens in good condition. Today however, I found only one poor specimen.

There was an abundance of limpets, Cellana radians, C. ornata and C. denticulata, on patches of sand at odd intervals between the weed beds. (There were, of course, no animals). On and in these sand patches were also Myadora striata in small numbers; I found only empty pairs.

One Zeacolpus vittatus was found wedged between two rocks, this shell is not common. Several of the similar Maoricolpus roseus came to my attention later on.

I spotted several Trochus viridus amongst the weed and also saw some of the Jingle shell Monia zelandica the latter of which had no animal.

I now had only five minutes of air left and had a final look for some little treasures. Such shells were the Penion dilatutus , this one had been abandoned and now housed a hermit crab, had three acorn barnacles growing on it and also had three

Maoricrypta monoxyla within its mouth. The final shells collected were Buccinulum lineum and then it was time to ascend.

As I swam up through the water the weed took on a bluish hue and the pink coralline growths, large vase shaped sponges, smaller red and yellow growths and small almost tropically coloured fish dwindled away beneath me until they were absorbed by the weed and water. The silver of the surface seemed to come down to meet me.

SHELLS COLLECTED AT RANGIPUTA BEACH, NORTHLAND

Mrs D.J. Boswell of Wanganui has collected shells at Rangiputa Beach on a number of occasions over the period 1965 to 1977. In the course of her visits to this locality she has obtained 120 different species and has compiled a list of her acquisitions. Every one of the 120 was not collected on each visit. This applies particularly to those species collected as washed up specimens, these not being regular components of the beach material.

In the list which follows, the circumstances of collection of the various species are indicated by the use of symbols as follows:-

S.G.	= in shell grit	L.T.R.P.	= in low tide rock pool
W.U.	= washed up	L.T.M.F.	= on low tide mud flat
L.T.	= at low tide	M.T.R.	= on mid tide rocks
L.T.R.	= on low tide rocks		

The order of listing and the species names are as in the 5th. edition of Powell's 'Shells of New Zealand'.

For the information of readers not familiar with the far north, Rangiputa is a small settlement on the east side of the entrance to Rangaunu Bay.

AMPHINEURA

Eudoxochiton nobilis (Gray 1843)	L.T.R.P.
Amaurochiton glaucus (Gray 1828)	L.T.R.
Sypharochiton sinclairi (Gray 1843)	L.T.R.
Cryptoconchus porosus Burrow 1815	L.T.R.

GASTROPODA

Haliotis (Sulculus) australis Gmelin 1791	L.T.R.
Tugali elegans Gray 1843	L.T.R.
Cellana denticulata (Martyn 1784)	L.T.R.
ornata (Dillwyn 1817)	L.T.R.
radians (Gmelin 1791)	L.T.R.
Patelloida cortica (Hutton 1880)	S.G.
Melagraphia aethiops (Gmelin 1791)	L.T.R.
Diloma (Diloma) nigerrima (Gmelin 1791)	L.T.R.
(Fractarmilla) zelandica (Quoy & Gaimard 1834)	L.T.R.
Cantharus opalus (Martyn 1794)	W.U.
purpureus (Gmelin 1791)	S.G.
Trochus (Coelotrochus) tiaratus Quoy & Gaimard 1843	S.G.
Maurea tigris (Gmelin 1791)	W.U.
punctulata (Martyn 1784)	W.U.
Umbonium (Zeanalia) zelandicum (Hombron & Jacquinot 1854)	S.G.
Turbo (Turbo) smaragdus Gmelin 1791	L.T.R.
Cookia sulcata (Gmelin 1791)	W.U.
Nerita (Melanerita) melanotragus (Smith 1884)	M.T.R.
Littorina (Austrolittorina) unifsciata antipodum Philippi 1847	M.T.R.
Eatoniella (Pellax) huttoni (Pilsbry 1888)	S.G.
Rissoina chathamensis (Hutton 1873)	S.G.
Maoricolpus roseus (Quoy & Gaimard 1834)	W.U.
Zeacolpus (Zeacolpus) vittatus (Hutton 1873)	W.U.
(Stiracolpus) pagoda (Reeve 1849)	W.U.

Siliquaria weldii (Tenison-Woods 1876)	S.G.
Zeacumantus lutulentus (Kiener 1841)	L.T.P.R.
subcarinatus (Sowerby 1855)	L.T.P.R.
Struthiolaria papulosa (Martyn 1784)	W.U.
Trichosirius inornatus (Hutton 1873)	S.G.
Zegalerus tenuis (gray 1867)	L.T.R.
Maoricrypta (Maoricrypta) costata (Sowerby 1824)	L.T.R.
(Zeacrypta) monoxyla (Lesson 1831)	L.T.R.
Lamellaria ophione Gray 1859	S.G.
Tonna cerevisina Hedley 1919	W.U.
Cabestana spengleri (Perry 1811)	L.T.R.
Monoplex parthenopeus (Salis 1793)	L.T.R.
Mayena australasia (Perry 1811)	L.T.R.
Charonia lampas capax Finlay 1927	L.T.
rubicunda (Perry 1811)	W.U.
Xymene plebieus (Hutton 1873)	S.G.
ambiguus (Philippi 1844)	W.U.
Paratrophon quoyi (Reeve 1846)	L.T.R.
Thais orbita (Gmelin 1791)	L.T.R.
Haustrum haustorium (Gmelin 1791)	L.T.R.
Lepsiella scobina (Quoy & Gaimard 1833)	L.T.R.
Zemitrella cf. stephanophora (Suter 1908)	S.G.
Cominella (Cominella) adspersa (Brugiere 1789)	L.T.
maculosa (Martyn 1784)	L.T.R.
(Josepha) glandiformis (Reeve 1847)	L.T.M.F.
quoyana Adams 1854	L.T.
virgata Adams 1853	L.T.R.
Buccinulum lineum (Martyn 1784)	L.T.R.
vittatum (Quoy & Gaimard 1833)	L.T.R.
Penion sulcatus (Lamarck 1816)	W.U.
Taron dubius Hutton 1878	L.T.R.
Amalda(Baryspira) australis (Sowerby 1830)	S.G.
depressa (Sowerby 1859)	S.G.
(Gracilispira) novaezelandiae (Sowerby 1859)	S.G.
Alcithoe (Alcithoe) swainsoni Marwick 1926	W.U.
Marginella (Haloginella) mustelina (Angas 1871)	S.G.
(Sinuginella) pygmaea Sowerby 1846	S.G.
Phenatoma rosea (Quoy & Gaimard 1833)	L.T.R.
zelandica (Smith 1877)	L.T.
Tomopleura (Maoritomella)albula (Hutton 1873)	S,G,
Neoguraleus sinclairi (Gillies 1882)	S,G,
Duplicaria (Pervicacia) tristis (Deshayes 1859)	S,G,
Epitonium (Acutiscala) minora (Iredale 1936)	S,G,
(Hyaloscala) jukesianum (Forbes 1852)	S,G,
Cirostrema (Cirostrema) zelebori (Dunker 1866)	S,G,
Bullina lineata (Gray 1825)	L.T.R.P.
Hydatina physis (Linnaeus 1758)	L.T.
Bulla quoyi Gray 1843	W.U.
Haminoea zelandiae (Gray 1843)	W.U.
Amphibola crenata (Gmelin 1791)	L.T.M.F.
Ophicardelus costellaris (Adams 1854)	L.T.
Marinula filholi Hutton 1878	S.G.

BIVALVIA

Nucula hartvigiana Pfeiffer 1864	L.T.
Solemya parkinsoni Smith 1874	W.U.
Glycymeris (Grandaxinea) laticostata (Quoy & Gaimard 1835)	W.U.
(Glycymerula) modesta (Angas 1879)	W.U.
Perna canaliculus (Gmelin 1791)	L.T.R.
Modiolus aerolatus (Gould 1850)	L.T.R.
Modiolarca impacta (Hermann 1782)	W.U.

Xenostrobus pulex (Lamarck 1819)	L.T.R.
Atrina zelandica (Gray 1835)	W.U.
Crassostrea glomerata (Gould 1850)	L.T.R.
Pecten novaezelandiae Reeve 1853	W.U.
Chlamys (Chlamys) zelandiae (Reeve 1843)	W.U.
Limatula maoria Finlay 1927	W.U.
Divaricella (Divalucina) huttoniana (Vanatta 1901)	L.T.
Felaniella (Zemysia) zelandica (Gray 1835)	L.T.
Myllita (Zemyllita) stowei (Hutton 1873)	S.G.
Venericardia (Purpurocardia) purpurata (Deshayes 1854)	L.T.
Longimactra elongata (Quoy & Gaimard 1835)	W.U.
Spisula (Crassula) aequilateralis (Deshayes 1854)	W.U.
Resania lanceolata Gray 1852	W.U.
Paphies (Paphies) australis (Gmelin 1791)	L.T.
(Mesodesma) subtriangulata (Wood 1828)	L.T.
Tellina (Peronidia) gaimardi (Iredale 1915)	W.U.
(Macomona) liliana Iredale 1915	W.U.
Zearcopagia disculus (Deshayes 1855)	L.T.R.P.
Gari stangeri (Gray 1843)	W.U.
Soletellina nitida (Gray 1843)	W.U.
Leptomya retiaria (Hutton 1885)	L.T.M.F.
Dosinia (Asa) lambata (Gould 1850)	L.T.
(Phacosoma) subrosea (Gray 1835)	W.U.
(Austrodosinia) anus (Philippi 1848)	L.T.
Tawera spissa (Deshayes 1835)	L.T.
Notirus reflexus (Gray 1843)	L.T.R.P.
Venerupis (Paphirus) largillierti (Philippi 1849)	W.U.
Chione (Austrovenus) stutchburyi (Wood 1828)	L.T.
Bassina yatei (Gray 1835)	W.U.
Hiatella arctica (Linnaeus 1767)	W.U.
Panopea zelandica (Quoy & Gaimard 1835)	W.U.
Anchomasa similis (Gray 1835)	W.U.
Myadora striata (Quoy & Gaimard 1835)	W.U.

NEW ZEALAND TONNIDAE

BY W. J. PAUL

For many years , up to the 1920's when Tonna tetracotula was added to the fauna, only one species of Tonnidae was recognised in New Zealand. This was referred to as Tonna variegata, a name now used for a West Australian shell. Today we have a list of eight species of the Family Tonnidae known to live in our coastal waters. Empty shells of additional species have been collected suggesting that other species may be present.

The presence of several species of Tonnidae in this country is really not surprising in view of the type of life history of this group of molluscs. The larval form of Tonna is a not infreqent component of tropical and sub-tropical plankton. Tonna larva when first collected were not recognised for what they really are. In 1847, John MacGillivray collected plankton off the northern coast of New South Wales. Among the material collected was a small creature which Prof. E. Forbes named Macgillivrayia pelagica in 1851. It was not until 1863 that Dr Paul Fischer concluded that Macgillivrayia was a larval Dolium (a genus later replaced by Tonna). Macgillivrayia pelagica cannot however be deemed to be the larva of any particular species of Tonna. The larval stage in this family is apparently fairly long lived, which enables the distribution of species over large areas. Most of the species of the family have a very wide range. The total number of species is comparatively small, but they range throughout the Indian and Pacific Oceans from South Africa to Hawaii, and from Japan down to New Zealand. Several species are found in the Caribbean area, one is in the Mediterranean, and another in West Africa, and one in west tropical America.

A major problem in the study of tonnid distribution is the lack of agreement on the validity of many of the names which have been introduced. The family has not been reviewed for a long time. The last major paper on the Australasian forms was " A Review of Australian Tun Shells " by Charles Hedley in 1919 (Rec. Australian Mus. Vol 12). Hedley did a masterly job at the time, but there has not been a further major paper since and synonymies now listed cannot be accepted as final.

Tonna cerevisina Hedley 1919

The shell listed by Suter in his 'Manual of New Zealand Mollusca' 1913, as Tonna variegata Lamarck 1822, was renamed by Hedley in 1919 as a sub-species of his new species Tonna cerevisina, of eastern Australia which had also been previously referred to as Tonna variegata. The latter name was shown to be referrable to the common form in Western Australia.

When Dr C. E. R. Bucknill wrote 'Sea Shells of New Zealand' 1924, he was apparently unaware of Hedley's work and he continued the the use of the name Tonna variegata.

In the 5th edition of his 'Shells of New Zealand' Powell has treated the New Zealand shell as being the same as the eastern Australian species and not warranting sub-specific rank.
In New Zealand, Tonna cerevisina occurs over a considerable part of the North Island coasts. On the west coast it has been collected as far south as Kapiti Island, and broken pieces of shell

have been collected on shore near the entrance to Porirua Harbour.

In Australia the most southerly occurrence appears to be in the vicinity of Lakes Entrance in Victoria. From there it ranges northwards to northern Queensland. It occurs beyond Australia at Fiji, New Caledonia, Norfolk Island and Lord Howe Island.

Some authors have raised the question of Tonna cerevisina and Tonna variegata being con-specific, or possibly end-of-range forms of a single species. The main difference between the two is the presence of small riblets between the ribs on the shoulders of the shells in variegata. (Users of Dance's "Encyclopedia of Shells" will observe that he has the two species reversed in this respect.) This feature is however not consistent. The geographical ranges of the two forms seem quite separate, with a wide gap in between in which the presence of this type of mollusc would not be expected. Lakes Entrance in Victoria, appears to be the south-west limit of cerevisina.

To my knowledge, the eastern limit of variegata is Eucla, in the Great Australian Bight. Between these limits is over a thousand miles of Australia's coldest water, quite an unsuitable habitat for Tonna. As yet, no intermediate forms have been brought to light by collecting along the Northern Territory in which direction some connecting link between the two species would appear most likely to be discovered. So, at the moment the most satisfactory solution is to maintain the two as separate species.

Tonna tetracotula Hedley 1919

This was the second species of Tonna to be recorded in New Zealand. A specimen trawled near the entrance to Hauraki Gulf was recorded by Powell (Trans. N.Z. Inst. Vol 57 1927).

Hedley separated this species from Tonna sulcosa (Born 1778) by a number of features which later collecting has shown not to be constant. Further study may show tetracotula to be a sub-tropical form of sulcosa.

Tonna tetracotula as at present recognised, has been collected at several localities in the far north of New Zealand. Its Australian distribution is confined to the coast of New South Wales and southern Queensland.

Tonna cumingii Reeve 1849

In 1938 Powell described a new species, Tonna maoria, from a specimen collected at Houhora Heads, North Auckland, and stated that it appeared allied to Tonna cumingii . This was the third species of Tonna to be recorded in New Zealand.

Tonna cumingii is a species of variable colour pattern, and wide geographical range. It is far from common, and generally collected by trawling in deep water. Beyond New Zealand it occurs in eastern Australian waters, and from Indonesia through the Phillipines to Japan.

The type of Tonna maoria is undoubtedly a specimen of cumingii. Some doubt exists as to whether cumingii itself is indeed a valid

species. The distinction between cumingii and Tonna chinensis Dillwyn 1817 is very slight, both the sculpture and the colour patterns of the two species having great similarity. Tonna cumingii may yet be shown to be a form of chinensis or even identical with it.

Tonna luteostoma (Kuster 1857)

This species has been recorded by Powell as being collected in the far north (Recs. Auck. Inst. & Mus. Vol. 8 p216... 1971).

One of the largest of the Tonnas reaching up to 200mm in lenghh , it is not a common species. Its distribution appears to be a north-south strip of the western Pacific Ocean stretching from New Zealand up to Japan, including the north-eastern coast of Australia. The species has been recorded on the coast of Mozambique, but identity of the specimens there requires confirmation.

Tonna maculata (Lamarck 1822)

This is another species recorded in the far north by Powell (Recs. Auck. Inst. & Mus. Vol. 6 p15)

Here we have another species of Tonna in doubt as to its validity. Cernohorsky (Marine Shells of the Pacific" Vol. 2 p110) treats maculata as a synonym of Tonna dolium (Linne 1758).

Tonna maculata (=dolium?) has a wide distribution in the Indian Ocean and the western Pacific. It is known in Malaysia, Indonesia, tropical Australia, Taiwan, Fiji and Japan.

Tonna melanostoma (Jay 1839)

Another tropical species recorded by Powell (Recs. Auck. Inst. & Mus . Vol. 6 p 190) in northern New Zealand.

This is a species more of the central rather than the western Pacific area. Its presence in Hawaii is well recorded. Its eastern limit appears to be the Society Islands, and it extends westwards into the Melanesian area, but I am not aware of it being collected in Australia.

Tonna olearium (Linne 1758)

Still another recording by Powell of a tropical Tonna in New Zealand (Recs. Auck. Inst. & Mus. Vol. 6 p 191).

One of the larger species of Tonna, up to about 200mm in length, recognised by the presence of interstitial riblets between main ribs throughout the whole shell. It has great similarity to Tonna galea (Linne 1758) which is widely distributed in the Pacific Ocean and is also found in the West Indies.

Tonna olearium is mainly confined to the area around Japan, the Phillipines, and Indonesia, I am not aware of its presence in Australian waters.

Tonna perdix (Linne 1758)

Undoubtedly Tonna perdix is the commonest of all the Indo-Pacific species. It is quite common in eastern Australia and reaches as far east as Hawaii and north to Japan.

Empty shells have been collected in New Zealand, but as yet no live specimens have been recorded.

Malea pomum (Linne 1758)

An empty shell of this tonnid has been collected here, but that is really insufficient evidence on which to include it in our faunal list. As it is a common shell in the tropical Pacific it may some time be located in our northern waters.

Eudolium pyriforme (Sowerby 1914)

Specimens of this shell have been found in northern New Zealand waters. Live specimens have been recorded.

Around Japan it is not uncommon, but to the south of the Japanese islands the occurrences are infrequent. It has been dredged off the coast of New South Wales. I am not aware of it appearing at any any other locations on the east Australian coast.